CLAIMS

What is claimed:

1. A concentrated beam source for a projector comprising:

a plurality of individually addressable light sources configured in a two-dimensional array; and

a beam concentrator configured to receive light from the plurality of light sources and to produce a reduced beam of collimated light having a component representative of each light source and having cross-sectional dimensions smaller than cross-sectional dimensions of the two-dimensional array.

2. The beam source of claim 1, which further comprises scanning optics configured to deflect the reduced beam in a two-dimensional scan pattern.

3. The beam source of claim 2, wherein the scanning optics are further configured to produce successive overlapping two-dimensional scan patterns.

4. The beam source of claim 1, wherein the plurality of light sources produces a collimated beam of light having a component representative of each light source.

5. The beam source of claim 1, wherein the plurality of light sources includes at least one of a light-emitting semiconductor device and a laser.

6. The beam source of claim 5, wherein the plurality of light sources includes at least one of a light-emitting diode and a vertical cavity surface emitting laser.

7. The beam source of claim 1, wherein the beam concentrator includes an afocal beam expander having one or more refractive, reflective, or diffractive optical elements.

8. The beam source of claim 1, wherein the beam concentrator includes a Galilean beam expander having a lens or a group of lenses having positive power and a lens or a group of lenses having negative power.

9. The beam source of claim 1, wherein the beam concentrator includes a Keplerian beam expander having a plurality of lenses or groups of lenses having positive power.

10. The beam source of claim 1, wherein the beam concentrator produces a reduced beam having cross-sectional dimensions less than one fourth the cross-sectional dimensions of the two dimensional array.

11. The beam source of claim 1, wherein the beam concentrator produces a reduced beam having cross-sectional dimensions less than one tenth the cross-sectional dimensions of the two-dimensional array.

12. A concentrated beam source for a projector comprising:

a plurality of individually addressable light sources, including at least one of a light-emitting semiconductor device and a laser, configured in a two-dimensional array to produce a collimated source beam of light having a component representative of each light source;

a converging lens configured to receive the source beam and focus the beam toward a focal point; and

a diverging lens configured to convert the focused beam into a reduced beam of collimated light having a component representative of each light source and having cross-sectional dimensions smaller than cross-sectional dimensions of the collimated source beam.

13. The beam source of claim 12, which further comprises scanning optics configured to deflect the reduced beam in a two-dimensional scan pattern.

14. The beam source of claim 13, wherein the scanning optics are further configured to produce successive overlapping two-dimensional scan patterns.

15. A projector comprising:

a plurality of individually addressable light sources configured in a two-dimensional array;

a beam concentrator configured to receive light from the plurality of light sources and to produce a reduced beam of collimated light having a component representative of each light source and having a cross-sectional area smaller than a cross-sectional area of the two-dimensional array; and

display optics configured to receive the reduced beam and project toward a viewing surface a projected beam representative of the reduced beam.

16. The projector of claim 15, wherein the plurality of light sources produces a collimated source beam of light having a component representative of each light source.

17. The projector of claim 15, wherein the plurality of light sources includes at least one of a light-emitting semiconductor device and a laser.

18. The projector of claim 17, wherein the plurality of light sources includes at least one of a light-emitting diode and a vertical cavity surface emitting laser.

19. The projector of claim 15, wherein the beam concentrator includes a converging lens and a diverging lens.

20. The projector of claim 15, wherein the beam concentrator includes an afocal beam expander having one or more refractive, reflective, or diffractive optical elements.

21. The projector of claim 15, wherein the beam concentrator includes a Galilean beam expander having a lens or a group of lenses having positive power and a lens or a group of lenses having negative power.

22. The projector of claim 15, wherein the beam concentrator includes a Keplerian beam expander having a plurality of lenses or groups of lenses having positive power.

23. The projector of claim 15, wherein the display optics includes scanning optics and projection optics, the scanning optics being configured to deflect the reduced beam in a manner causing, when projected by the projection optics, an image of the light source array to scan across a viewing surface.

24. The projector of claim 23, wherein the scanning optics are configured to deflect the reduced beam in a two-dimensional scan pattern.

25. The projector of claim 23, wherein the scanning optics are configured to deflect the reduced beam in successive, overlapping two-dimensional scan patterns.

26. The projector of claim 15, wherein the beam concentrator produces a reduced beam the cross-sectional area of the reduced beam being less than one fourth the cross-sectional area of the two-dimensional array.

27. The projector of claim 15, wherein the beam concentrator produces a reduced beam the cross-sectional area of the reduced beam being less than one tenth the cross-sectional area of the two-dimensional array.

28. A projector comprising:

a plurality of individually addressable light sources, including at least one of a light-emitting semiconductor device and a laser, configured in a two-dimensional array to produce a collimated source beam of light having a component representative of each light source;

a converging optical device configured to receive the source beam and focus the beam toward a focal point;

a diverging optical device configured to convert the focused beam into a reduced beam of collimated light having a component representative of each light source and having dimensions smaller than dimensions of the collimated source beam;

scanning optics configured to deflect the reduced beam in a two-dimensional pattern; and

projection optics configured to project the scanning beam toward a viewing surface.

29. The projector of claim 28, wherein diverging optical device includes an afocal beam expander having one or more refractive, reflective, or diffractive optical elements.

30. The projector of claim 28, wherein the beam concentrator includes a Galilean beam expander having a lens or a group of lenses having positive power and a lens or a group of lenses having negative power.

31. The projector of claim 28, wherein the beam concentrator includes a Keplerian beam expander having a plurality of lenses or groups of lenses having positive power.

32. A method of producing a concentrated beam for a projector comprising:

producing light from a plurality of individually addressable light sources configured in a two-dimensional array;

forming a reduced beam of light from the light produced by the plurality of light sources, the reduced beam having a plurality of components, with each component representative of at least one active light source, the reduced beam of light having a cross-sectional area smaller than a cross-sectional area of the two-dimensional array; and

collimating the reduced beam of light.

33. The method of claim 32, which further comprises scanning the collimated reduced beam in a two-dimensional scan pattern.

34. The method of claim 32, which further comprises scanning the collimated reduced beam in successive two-dimensional scan patterns.

35. The method of claim 32, wherein producing light includes producing a collimated beam of light having a component representative of at least one active light source.

36. The method of claim 32, wherein forming a reduced beam of light includes converging the light produced by the plurality of light sources.

37. The method of claim 32, wherein forming a reduced beam includes forming a reduced beam of cross-sectional area less than one fourth the cross-sectional area of the two-dimensional array.

38. The method of claim 32, wherein forming a reduced beam includes forming a reduced beam of cross-sectional area less than one tenth the cross-sectional area of the two-dimensional array.

39. A concentrated beam source for a projector comprising:

means for producing a two-dimensional array of individual light beams; and

means for receiving the individual light beams and for producing a reduced two-dimensional array collimated light beams, the reduced two-dimensional array having a component representative of each individual light beam and having cross-sectional dimensions smaller than cross-sectional dimensions of the two-dimensional array of individual light beams.

40. The beam source of claim 39, which further comprises means for deflecting the reduced two-dimensional array of individual light beams in a two-dimensional scan pattern to produce an image.

41. The beam source of claim 39, which further comprises means for the reduced two-dimensional array of individual light beams in successive, overlapping two-dimensional scan patterns to produce an image.

42. The beam source of claim 39, wherein the means for producing the two-dimensional array of individual light beams is further for producing collimated light having components representative of each of a plurality of individually addressable light sources.

43. The beam source of claim 42, wherein the plurality of individually addressable light sources includes at least one of a light-emitting semiconductor device and a laser.

44. The beam source of claim 43, wherein the plurality of individually addressable light sources includes at least one of a light-emitting diode and a vertical cavity surface emitting laser.

45. The beam source of claim 39, wherein the means for producing a reduced two-dimensional array of collimated light beams includes means for converging the individual light beams received and means for diverging converging individual light beams received from the means for converging the individual light beams.

46. A method of making a concentrated beam source for a projector comprising:

providing a plurality of individually addressable light sources configured in a two-dimensional array; and

providing a beam concentrator configured to receive light from the plurality of light sources and to produce a reduced beam of collimated light having a component representative of each light source and having cross-sectional dimensions smaller than cross-sectional dimensions of the two-dimensional array.

47. The method of claim 46, which further comprises providing scanning optics configured to deflect the reduced beam in a two-dimensional scan pattern.

48. The method of claim 46, wherein the scanning optics are further configured to deflect the reduced beam in successive overlapping two-dimensional scan patterns.

49. The method of claim 46, wherein providing a plurality of light sources includes providing a plurality of light sources that collectively produce collimated light having components representative of each active light source.

50. The method of claim 46, wherein providing a beam concentrator includes providing a converging lens and a diverging lens.

51. The method of claim 46, wherein providing a beam concentrator includes providing a diverging optical device including an afocal beam expander having one or more refractive, reflective, or diffractive optical elements.

52. The method of claim 46, wherein providing a beam concentrator includes providing a Galilean beam expander having a lens or a group of lenses having positive power and a lens or a group of lenses having negative power.

53. The method of claim 46, wherein providing a beam concentrator includes providing a Keplerian beam expander having a plurality of lenses or groups of lenses having positive power.

54. An electronic device comprising:

a plurality of individually addressable light sources configured in a two-dimensional array;

a beam concentrator configured to receive light from the plurality of light sources and to produce a reduced array of collimated light having a component representative of each active light source and having cross-sectional dimensions smaller than cross-sectional dimensions of the two-dimensional array; and

display optics configured to receive the reduced array and project toward a viewing surface a representation of the reduced array.

55. The electronic device of claim 54, wherein the plurality of light sources produces collimated light having components representative of each active light source.

56. The electronic device of claim 54, wherein the beam concentrator includes a converging lens and a diverging lens.

57. The electronic device of claim 54, wherein the display optics includes scanning optics and projection optics, the scanning optics being configured to deflect the reduced array in a manner causing, when projected by the projection optics, an image of the light source array to scan across a viewing surface.

58. The electronic device of claim 54, wherein the scanning optics are configured to deflect the reduced array in a two-dimensional scan pattern.

59. The electronic device of claim 54, wherein the scanning optics are configured to deflect the reduced array in successive, overlapping two-dimensional scan patterns.

60. The electronic device of claim 54, further comprising a controller configured to control operation of the plurality of light sources based on an image signal.

61. A spatial light modulator comprising:

a light signal generator including plural individually addressable light sources configured in a two-dimensional array;

concentrated beam optics including a beam concentrator configured to receive light from the plurality of light sources and to produce a reduced beam of collimated light having a component representative of each light source and having cross-sectional dimensions smaller than cross-sectional dimensions of the two-dimensional array; and

display optics including scanning optics configured to deflect the reduced beam in a two-dimensional scan pattern.

62. The spatial light modulator of claim 61, wherein the scanning optics are further configured to produce successive, overlapping two-dimensional scan patterns.